Sub Wavelength Imaging Using Anisotropic Media

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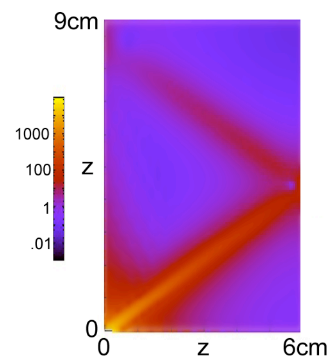
Waves propagate in anisotropic magnetic media according to the formula[1,2,3],

$$k_x^2 / \mu_z + k_z^2 / \mu_x = k_0^2 = \omega^2 / c_0^2$$

As a result $k_x^2 >> k_0^2$ would normally imply that k_z is imaginary. Hence high resolution Fourier components of an image are normally confined to the vicinity of a surface. However if μ_x and μ_z have opposite signs both k_x and k_z can increase without limit and remain real. In such a medium fine details of an object can be transported, attenuated only by the losses encountered. In this paper we report an analytic solution for the propagation of waves across a slab of material and compare the analytical results to a full FDTD calculation and to experiment.



Intensity of the magnetic field, H_z^2, due to a point source at $x = z = 0$ showing reflection at the boundary of the medium located at $z = 6\text{cm}$. In this medium at 23.4MHz:

$$\mu_x = 1, \mu_z = -1.8 + 0.28i$$

[1] D.R. Smith and D. Schurig, *Phys. Rev Lett.*. **90** 077405 (2003).
[2] K.G. Balmain, A.A.E. Luttgen, and P.C. Kremer, *IEEE Antennas Wireless Propag. Lett.* **1** 146 (2002).
[3] S. A. Ramakrishna and J.B. Pendry *Phys. Rev.* **B67** 201101 (2003).